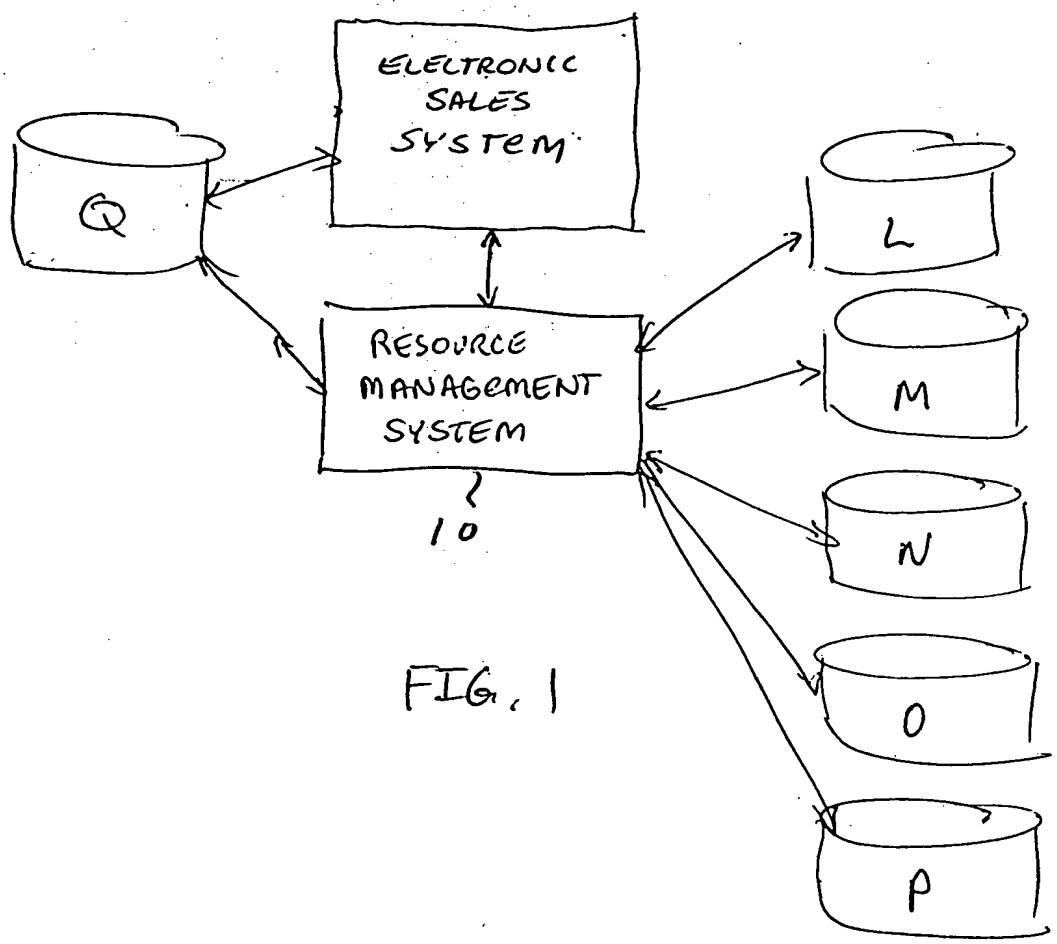


FIG. 1

FIG. 2A

General Information	Plant Name	
	Address	
	City	
	State	
	Zip	
	Phone	
	Fax	
	Contact	
	User Size	
	Industry	
Plant Profile	# of pumps/mixers	
	# of seals per pump	
	# of sealed stuffing boxes in Plant	
	% of pumps sealed	
	% of pumps packed	
	Average seal list price	
	% of seals purchased new annually	
	% of seals purchased as factory repair or rebuild kits annually	
	Factory repair/rebuild price as a % of new seal price	
	% of population requiring solid shaft seals	
	Avg. shaft seal size (in inches) in plant	
	# of Pumps, Mixers, Flushed With Seal Water into packed boxes	
	# of Pumps, Mixers, Stuffing Boxes which are flushed with seal water which require evaporation later on. (Ex. Dilute black liquor pumps in pulp & paper industry.	
Cost Information	Proposed Estimated Annual Seal Expenditure. (Revised Plant Estimate New Seals Only)	
	Average Seal List Price Per Seal	
	Average Cost of 1 hour of Labor With All Benefits Included	
	Average Cost of Shaft or Sleeve Damage	
	Avg. Cost for Bearings, Lip Seals, Gaskets, Etc.	
	Additional Cost of Seasoned Trained Professional vs. Novice Per Hour	
	Cost Per Seal Per Year For Housecleaning (Please Estimate)	
	Annual Cost Of Production Dowtime	
	Actual/Estimated Plant Cost for One Failure	
	Cost of Electricity Per Kilowatt Hours	
	Average Cost Of Packing Set	
	Cost of Seal Flush Water Per 1,000 Gallons	
	Evaporation Cost of 1 Gallon of Water	
	Cost of 1 million BTUs	
	Ex. If Plant Seal Water Costs Are .15/1000 gallons and effluent treatment costs are .75/1000 gallons .75/.15 = 5	
	Avg. Cost of Product/Gal. (Please keep in mind that fluids like condensate have a cost and should be included)	

	Avg. Labor Cost of Unscheduled Repairs & Maintenance & Operations Combined)	
	Production Cost of Machine Time Per Hour (Ex. Paper Machine)	
	Cost of Housekeeping Service/Hours	
	Split & Unsplit Average Price For Single W/Flow Meter or Double Seal Per Inch (Shaft Sleeve Dia.)	

FIG. 2B

	Plant Seal Population	# of Seals In Plant	Improper Rotary Design		Excessive Unbalanced Design		Inadequate Double Seal Design		Inferior Face Material		Excessive Tight Clearance Designs		Unreliable Installation		Spring Failure When Immersed in process fluid		Metal Bellow Failure When Immersed in process fluid		Rotary Face Under Tension		Inferior Gland Flush Design		Other Design Deficiencies From F&B Chart		Est. % Decrease in Seal Life For Model Selected	Seal Price Ratio To Dbl Cart. Seal
			Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %		
	.000 ~ 3.2																									
Cart. Sgle Seals	1-9; 9T; 9Sgl ~ 30	0	0	33		25				50		200		25		100								25		458	49.4
			0																							
			0																							
			0																							
			0																							
Cart. ...le ...als			0																							
			0																							
			0																							
			0																							
			0																							
Split Seals			0																							
			0																							
			0																							
			0																							
			0																							
Cart. Spec. Seals			0																							
			0																							
			0																							
			0																							
			0																							
Comp Seals Sgle & Dble			0																							
			0																							
			0																							
			0																							
			0																							
			0																							
			0																							
			0																							
Other Seals			0																							
Plant Seal Population		0	0	Average Decrease in Seal Life For The Entire Plant Seal Population Due To Existing Design Deficiencies: %																							0.0

FIG. 5

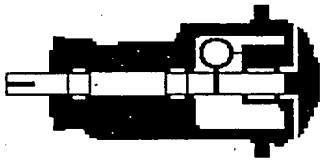
This is one example of item on a check list

The supplier of product responsibility identifier

This checklist enables front line workers to identify existing conditions in the ield which drive all decisions regarding repair/rebuild and purchase of parts, etc The equipment checklists act as the real world indicator to arrive at scientific precise life expectancy which up until now was only obtained in labratory conditions.

This section when completed in the field automatically feeds information back to equipment mfgs holding them responsible for life of the product and all costs associated with it. This may becom obsolete over time due to the fact that mfgs will not be able to supl these specificatins in the future as customers will demand real worl solutions.

Knowledge Based Pictorial/Checklist

				Verification Method				When To Check	Pump Mfg. Specifications: What to Check Against	Seal Mfg. Specifications: What to Check Against	Accountable Party Signoff	Specifications Good/No Good
				Use a dial indicator to verify perpendicularity between the stuffing box face and the shaft O.D.				5 Performed in shop before equipment is disassembled.	Manufacturers Specifications: Stuffing Box Face Perpendicularity Recommended .007" TIR max.	Manufacturers Specifications: Stuffing Box Face Perpendicularity Recommended .003" TIR max.	Example: Seal Mfg assumes responsibility for performance	No Good Value: .017
			Actual	0-.002	.002 - .005	.005- .010	.010 - .020	.020 - .030				
				912 days	386 days	196 days	121 days	45 days			Mfg is held accountable	Recorded from drop down menus
							*					
General Design		Cartridge & Component	Single Design									
			Double Design									
			Cartridge Design									
			Component Design									
			Stationary Design	0	0	0	0	0				
			Rotary Design	25	50	75	100	200				
			Balanced Design									
			Unbalanced Design									
			Tandem Design									
			Back to Back Design									
			Internally Mounted Design									
			Externally Mounted design									
			Large Clearance Design									
			Tight Clearance Designs									
			Double seal with pumping ring design									
			Double seal without pumping ring design									

* = the recorded value that applies to your organization.

FIG. 4

40

FIG. 5A

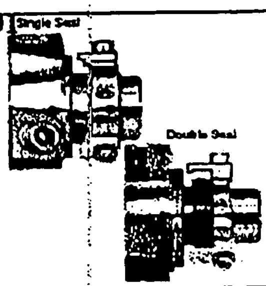
Seal Failure Analysis Inspection Form

To perform a seal failure analysis, you have been provided photos for all seal types typically found in service. Simply click on the photo(s) that best identifies the conditions of the seal you are analyzing.

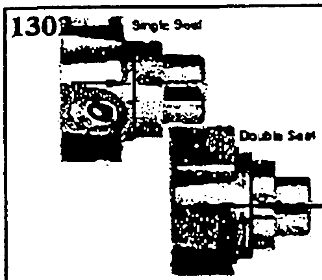
After all applicable pictures have been selected, click on the "**When Failure Analysis Is Compl te Click Here T Go To Seal Failure Analysis Report and Add Additional Comments/Notes If Required.**" button to continue.

If safety issues allow, inspect parts before and after cleaning as photos require.

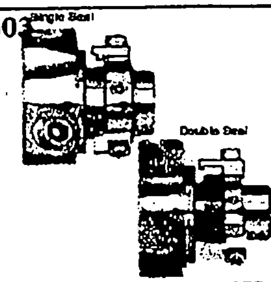
Cartridge Seal: Seal Settings

1301


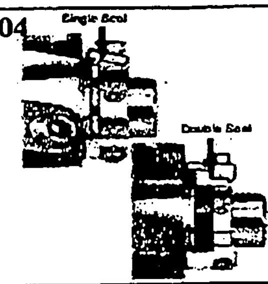
Incorrect settings due to seal being over compressed: Gap between lock collar and gland is too large. (Axial Direction)

1302


Incorrect settings due to seal being under compressed: Gap between lock collar and gland is too small. (Axial Direction)

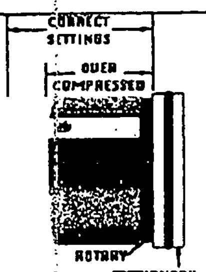
1303


Incorrect settings due to gland face to shaft/sleeve not being perpendicular.

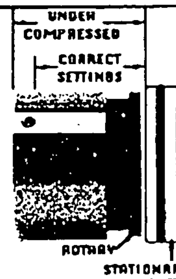
1304


Incorrect settings due to shaft/sleeve being off centered to gland. Radial off-centering (up, down, left or right) between shaft/sleeve and gland ID

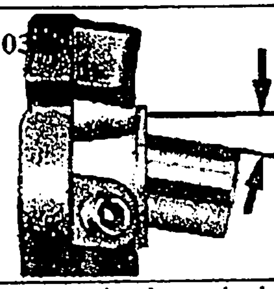
Component Seal: Seal Setting

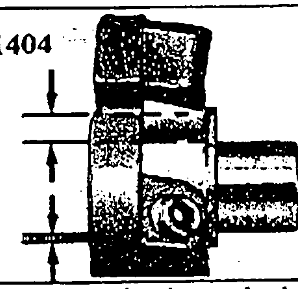
1401


Incorrect setting due to seal being over compressed: Setting of rotary unit is wrong causing the seal to be over compressed.

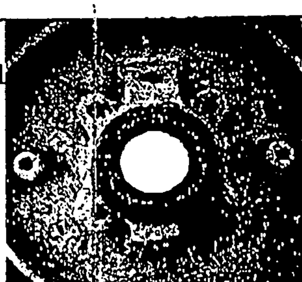
1402


Incorrect setting due to seal being under compressed: Setting of rotary unit is wrong causing the seal to be under compressed.

1403

Incorrect setting due to gland face to shaft/sleeve not being perpendicular.

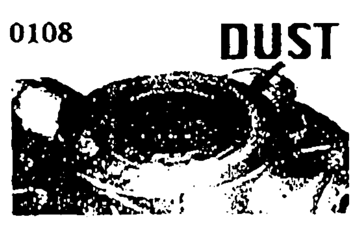
1404

Incorrect setting due to gland not being centered to shaft.

Cartridge Seal: Environment

01

Seal area packed with product

0102

Seal gland packed with product

0108


Carbon dust visible on front or ID of gland.

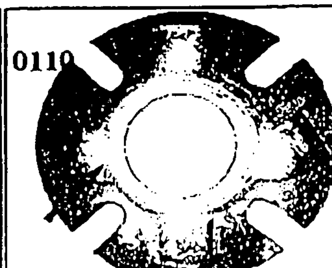
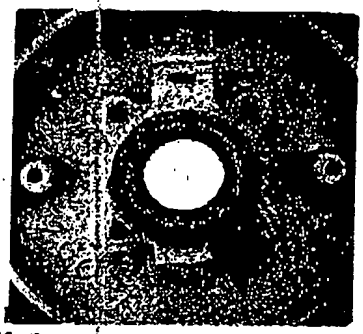
0110

Crystalization/Solidification of product on atmospheric side of gland

FIG. 5B



Seal area packed with product

Click [illegible] identify the most probable cause of failure

RGA.FP5RGA Form

50 7

Reason	Cause	Verification	Corrective Acti n
Thermal sensitive fluids are not maintained in liquid state in the seal area, causing it to build up on seal components	Cartridge: Seal chamber temperature is raised or lowered beyond the solidification point of the process fluid.	Cartridge: Verify the actual solidification point of the process fluid and the temperature maintained in the stuffing box seal area.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
Undissolved solids pack up in the seal area and on the seal components	Cartridge: Heavy concentration of undissolved solids are allowed to accumulate in the seal area.	Cartridge: Verify concentration of the % of solids present in the process stream.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
Undissolved fibrous solids pack up in the seal area on the seal components	Cartridge: Heavy concentration of fibrous solids are allowed to accumulate in the back cover/stuffing box.	Cartridge: Verify concentration of the % of solids present in the process stream.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
Thermal cycling resulting in premature seal failure.	Inferior Casing Design For Temperature Control	Please confirm that an inferior casing design for temperature control is being used.	Replace with a superior casing design for temperature control.
Thermal sensitive fluids are not maintained in liquid state in the seal area, causing it to build up on seal components	Component: Seal chamber temperature is raised or lowered beyond the solidification point of the process fluid.	Component: Verify the actual solidification point of the process fluid and the temperature maintained in the stuffing box seal area.	Component: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.

Skill Level Available 62

					Specify														
					Analyze Constraints			Gather Information To Make Purchasing Decision			Assess Information			Perform Analysis			Decide on Repair/Rebuild of product or service		
					Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level	
						John	Mary		John	Mary		John	Mary		John	Mary		John	Mary
					5												6	7	8
				Product/Service Skill Level Rating Required (Example. A Component Mechanical Seal)															
General Design		Cartridge & Component	Single Design																
			Double Design																
			Cartridge Design																
			Component Design																
			Stationary Design																
			Rotary Design																
			Balanced Design																
			Unbalanced Design																
			Tandem Design																
			Back to Back Design																
			Internally Mounted Design																
			Externally Mounted design																
			Large Clearance Design																
			Tight Clearance Designs																
			Double seal with pumping ring design																
			Double seal without pumping ring design																
			High Balance Ratio																
			Low Balance Ratio																
			Spring Loaded Design																
			Metal Bellows Design																
			Light Spring Load Per Square Inch																
			High Spring Load Per Square Inch																
			Wide Face Width																
			Narrow Face Width																
Glands	Design	Cartridge & Component	Single Seal with Large Dual Tangential Flush Holes																
			Single Seal with Small Straight Drill Holes Or No Flush Holes																
			Double seal with two flush holes on same surface																
			Double seal with two flush holes 180 degrees apart																
	Materials of construction	Cartridge & Component	316SS Metallurgy																
			Alloy 20 Metallurgy																
			Hastelloy C Metallurgy																
			Titanium Metallurgy																
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified glands in repair/rebuild																
			Practice of not using OEM certified glands in repair/rebuild														50%	20%	40%

FIG. 6

76

Process Fluid: Acetone, Tem <210 F

Operating Conditions
System Recommendations

70

Seal Information

T-9,9,9

Seal Type: C1 & C2 require double seal

73 74 75

Section	Item	Seal Attributes	Seal Type Single	Seal Type Double	Metallurgy 316 SS	Metallurgy Alloy 20	Metallurgy Hast C	Metallurgy Titanium	Faces Carbon	Faces Alpha Sintered SC	Faces Rxn Bonded SC	Faces Nickel Bonded TC	Faces Plated TC	Faces Ceramic	Faces Chrome Oxide	Elastomers Viton	Elastomers EPR	Elastomers Teflon	Elastomers Aflas	Elastomers Kalrez	Elastomers Chemraz	Elastomers Graphoil	The increase or / MTBF / Estimated Product: Est. Life	Best in Class	Specify
				Double	A	A	A		A	A	A	A		A		N	A	A	N	A	A	A			
	Seal Mfg/Model																								
Glands (71) – Materials of construction – Cartridge & Component	316SS Metallurgy				0																				
Glands (71) – Materials of construction – Cartridge & Component	Alloy 20 Metallurgy																								
Glands (71) – Materials of construction – Cartridge & Component	Hastelloy C Metallurgy																								
Glands (71) – Materials of construction – Cartridge & Component	Titanium Metallurgy																								
Sleeves or Barrels – Materials of construction – Cartridge & Component	316SS Metallurgy																								
Sleeves or Barrels – Materials of construction – Cartridge & Component	Alloy 20 Metallurgy																								
Sleeves or Barrels – Materials of construction – Cartridge & Component	Hastelloy C Metallurgy																								
Sleeves or Barrels – Materials of construction – Cartridge & Component	Titanium Metallurgy																								
72 – I/B Rotary Face Materials of Construction – Cartridge & Component	Practice of using OEM certified faces in repair/rebuild																								
	Practice of not using OEM certified faces in repair/rebuild																								
	One Piece Carbon Soft Face Material Under Compression																								
	One Piece Carbon Soft Face Material Under Tension																								
	Two Piece Carbon Soft Face Material Under Compression																								
	Two Piece Carbon Soft Face Material Under Tension																								
	Practice of replacing soft seal faces on cartridge and component seals																								
	Practice of reusing relapped soft seal faces on cartridge and component seals																								
	One Piece Ceramic Hard Face Material Under Compression																								
	One Piece Thin Walled Ceramic Hard Face Material Under Tension																								
	Two Piece Ceramic Hard Face Material Under Compression																								
	Two Piece Ceramic Hard Face Material Under Tension																								
	One Piece Plated TC Hard Face Material Under Compression																								
	One Piece Plated TC Hard Face Material Under Tension																								
	Two Piece Plated TC Hard Face Material Under Compression																								
	Two Piece Plated TC Hard Face Material Under Tension																								
	One Piece Nick Bonded TC Hard Face Material Under Compression																								
	One Piece Nick Bonded TC Hard Face Material Under Tension																								
	Two Piece Nick Bonded TC Hard Face Material Under Compression																								
	Two Piece Nick Bonded TC Hard Face Material Under Tension																								
	One Piece Rxn Bond SC Hard Face Material Under Compression																								
	One Piece Thin Walled Rxn Bond SC Hard Face Material Under Tension																								
	Two Piece Rxn Bond SC Hard Face Material Under Compression																								
	Two Piece Rxn Bond SC Hard Face Material Under Tension																								
	One Piece Alpha SC Hard Face Material Under Compression																								
	One Piece Thin Walled Alpha SC Hard Face Material Under Tension	Yes																					77 212 Days Graphic 7804 1005		
	Two Piece Alpha SC Hard Face Material Under Compression																								
	Two Piece Alpha SC Hard Face Material Under Tension																								
	One Piece Chrome Oxide Hard Face Material Under Compression																								
	One Piece Chrome Oxide Hard Face Material Under Tension																								
	Two Piece Chrome Oxide Hard Face Material Under Compression																								
	Two Piece Chrome Oxide Hard Face Material Under Tension																								
	Practice of replacing hard seal faces on cartridge and component seals																								
	Practice of reusing relapped hard seal faces on cartridge and component seals																								
	Practice of replacing seal faces with corrosion/pitting on cartridge and component seals																								
	Practice of reusing seal faces with corrosion/pitting on cartridge and component seals																								

FIG. 7A

Viscosity triggers a 2 piece head Predetermined in the process fluid file.
If > 15001 - Consult factory for viscosity issues

Product Has Viscosity > 15000																	Product Has Viscosity < 15000
15500																	
rease or decrease in resource life increases or decreases the H, M, O resource costs as a result of all decisions when buying, using, or selling a																	
"H"					"M"		"O"										
Labor Cost, etc.					Cost of M		Cost of Item		Utilities				Safety		Environmental		
Install	Operate	Maintain	Dispose	Etc.	Cost of M	Etc.	Cost of Item	Etc.	Energy/ Electric	Water	Sewage	Etc.	Safety	Etc.	Environmental	Etc.	

FIG. 7B

Seal:		T-9-91-9 ~80
		Product/Service Skill Level Rating Required ~82
Seal Itself	Specify	7.5
	Purchase	5
	Install with generic installation instructions	10
	Install with engineered installation instructions	5
	Operate with generic operating instructions	5
	Operate with engineered operating instructions	2.5
	Disposal	2.5
	Sell	2.5
Repair / Rebuild of Seal	Specify	2.5
	Purchase	2.5
	Repair	7.5
	Disposal	5
	Sell	2.5
API Plans for Seal	Specify	7.5
	Purchase	2.5
	Install with generic installation instructions	7.5
	Install with engineered installation instructions	2.5
	Operate with generic operating instructions	5
	Operate with engineered operating instructions	2.5
	Disposal	7.5
	Sell	2.5

84

FIG. 8

		3196 (Pump)
Seal	AV3000175A (Seal)	Seal fits with no modifications
	AV3200175EA (Seal)	Seal fits with no modifications
	5610	Special gland modifications required
	Type 9	Special sleeve modificatins required
	155	
	123	

These results come from the CA & SS from ESP

FIG 9

		Process Fluid Acetone; Tem <210 F System Recommendations
Recommended Seal Type	Single	
	Double	Double
Metalurgy	316 SS	A
	Alloy 20	A
	Hast C	A
	Titanium	N
	Carbon	A
	Alpha Sintered SC	A
	Rxn. Bonded SC	A
Faces	Nickel Bonded TC	A
	Plated TC	N
	Ceramic	A
	Chrome Oxide	N
Elastomers	Viton	N
	EPR	A
	Teflon	A
	Aflas	N
	Kalrez	A
	Chemraz	A
	Graphoil	A
	C31- Mfg. Recommends The Useof A Model that supports an option two piece stationary head	No
	Pumping Feature Required	Yes
	Quench & Drain Required	No

FIG. 10

FIG. 11A

Skill Level Available	Specify	Analyze Constraints	Work Force Average Skill Level		5 ~1102
			Individual Skill Level	John	7 ~1100
				Mary	3
		Gather Information To Make Purchasing Decision	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Information	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Perform Analysis	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide on Repair/ Rebuild of product or service	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Safety Impact	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide Safety Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Environmental Impact	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide Environmental Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess QC Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide QC Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Mfgs. Capabilities	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide on Mfg.	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide on Specifications	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide and Prepare RFQ	Work Force Average Skill Level		7
			Individual Skill Level	Bill	10
				Ed	4
			Work Force Average Skill Level		7

FIG. 11B

Purchase	Receive RFQ Responses and Analyze	Individual Skill Level	Bill	10
			Ed	4
		Work Force Average Skill Level		7
	Make Decision To Buy Product	Individual Skill Level	Bill	10
			Ed	4
Install		Work Force Average Skill Level		6
	Assess equipment condition	Individual Skill Level	Jim	9
			Ray	3
		Work Force Average Skill Level		6
	Install Product	Individual Skill Level	Jim	9
			Ray	3
Operation		Work Force Average Skill Level		8
	Startup of Equipment	Individual Skill Level	Mike	10
			Jeff	6
		Work Force Average Skill Level		8
	Operation of Equipment	Individual Skill Level	Mike	10
			Jeff	6
Disposal		Work Force Average Skill Level		4
	Disposal of Equipment	Individual Skill Level	Wayne	6
			Terry	2
Sell		Work Force Average Skill Level		4
	Decide on Sale	Individual Skill Level	Sue	3
			Lori	5

FIG. 12A

7. Example of some of the data included in an "O Database" for an "O Resource" (Seals)

				John Crane\T-9;9t;9
				Seal Attributes
General Design 1200		Cartridge & Component	Single Design	Single
			Double Design	
			Cartridge Design	Cartridge
			Component Design	
			Stationary Design	
			Rotary Design	Yes
			Balanced Design	
			Unbalanced Design	Yes
			Tandem Design	
			Back to Back Design	
			Internally Mounted Design	
			Externally Mounted design	Yes
			Large Clearance Design	
			Tight Clearance Designs	Yes
			Double seal with pumping ring design	Yes
			Double seal without pumping ring design	
			High Balance Ratio	
			Low Balance Ratio	Yes
			Spring Loaded Design	
			Metal Bellows Design	
			Light Spring Load Per Square Inch	
			High Spring Load Per Square Inch	
			Wide Face Width	
			Narrow Face Width	
Glands				
	Design	Cartridge & Component	Single Seal with Large Dual Tangential Flush Holes	
			Single Seal with Small Straight Drill Holes Or No Flush Holes	Yes
			Double seal with two flush holes on same surface	
			Double seal with two flush holes 180 degrees apart	
	1204			
	Materials of construction	Cartridge & Component	316SS Metallurgy	Yes
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures 1202	Cartridge &	Practice of using OEM certified glands in repair/rebuild	
			Practice of not using OEM certified glands in repair/rebuild	
		Cartridge	Practice of replacing glands on cartridge seals with pitted surfaces	
			Practice of reusing glands on cartridge seals with pitted surfaces	
			Practice of replacing gland on cartridge seals with damaged (elongated) spring holes	
			Practice of reusing gland on cartridge seals with damaged (elongated) spring holes	
			Practice of replacing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of replacing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
		Component	Practice of replacing glands on component seals with pitted surfaces	
			Practice of reusing glands on component seals with pitted surfaces	
			Practice of replacing gland on component seals with damaged (elongated) spring holes	
			Practice of reusing gland on component seals with damaged (elongated) spring holes	
			Practice of replacing component seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing component seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	

			Practice of replacing component seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing component seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
Sleeves or Barrels	Materials of construction	Cartridge & Component	316SS Metallurgy	Yes
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge	Practice of using OEM certified sleeves in repair/rebuild	
			Practice of not using OEM certified sleeves in repair/rebuild	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of replacing sleeves on cartridge seals with damaged (elongated) spring holes	
			Practice of reusing sleeves on cartridge seals with damaged (elongated) spring holes	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of replacing sleeves on cartridge seals with pitted surfaces	
			Practice of reusing sleeves on cartridge seals with pitted surfaces	
			Practice of replacing damaged (fretted) sleeves on cartridge seals	
			Practice of reusing damaged (fretted) sleeves on cartridge seals	
		Component	Practice of using OEM certified barrels in repair/rebuild	
			Practice of not using OEM certified barrels in repair/rebuild	
			Practice of replacing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of reusing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of replacing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of reusing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of replacing rotary units on component seals with damaged (elongated) spring holes	
			Practice of reusing rotary units on component seals with damaged (elongated) spring holes	
			Practice of replacing barrels on component seals with pitted surfaces	
			Practice of reusing barrels on component seals with pitted surfaces	
			Practice of replacing damaged (fretted) rotary sleeves or barrels on component seals.	
			Practice of reusing damaged (fretted) rotary sleeves or barrels on component seals.	
Face Holders	Materials of construction	Cartridge & Component	316SS Metallurgy	
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified face holders in repair/rebuild	
			Practice of not using OEM certified face holders in repair/rebuild	
		Cartridge	Practice of replacing face holders on cartridge seals with pitted surfaces	
			Practice of reusing face holders on cartridge seals with pitted surfaces	
			Practice of replacing face holders on cartridge seals with worn drive/anti-rotation slots	
			Practice of reusing face holders on cartridge seals with worn drive/anti-rotation slots	
		Component	Practice of replacing face holders on component seals with pitted surfaces	
			Practice of reusing face holders on component seals with pitted surfaces	
			Practice of replacing face holders on component seals with worn drive/anti-rotation slots	

FIG. 123

			Practice of reusing face[redacted]s on component seals with worn drive/anti-rotation slots
	Materials of construction	Cartridge & Component	316SS Metallurgy
			Alloy 20 Metallurgy
			Hastelloy C Metallurgy
			Titanium Metallurgy
Lock Collars	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified lock collars in repair/rebuild
			Practice of not using OEM certified lock collars in repair/rebuild
		Cartridge	Practice of replacing cartridge seals with damaged/oversized set screw holes on lock collars.
			Practice of reusing cartridge seals with damaged/oversized set screw holes on lock collars.
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on lock collar
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) on lock collar
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on lock collar
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) on lock collar
			Practice of replacing lock collars on cartridge seals with pitted surfaces
			Practice of reusing lock collars on cartridge seals with pitted surfaces
		Component	Practice of replacing component seals with damaged/oversized set screw holes.
			Practice of reusing component seals with damaged/oversized set screw holes.
	I/B Stationary Face Materials of Construction	Cartridge & Component	Practice of using OEM certified faces in repair/rebuild
			Practice of not using OEM certified faces in repair/rebuild
			One Piece Carbon Soft Face Material Under Compression
			One Piece Carbon Soft Face Material Under Tension
			Two Piece Carbon Soft Face Material Under Compression
			Two Piece Carbon Soft Face Material Under Tension
			Practice of replacing soft seal faces on cartridge and component seals.
			Practice of reusing relapped soft seal faces on cartridge and component seals.
			One Piece Ceramic Hard Face Material Under Compression
			One Piece Ceramic Hard Face Material Under Tension
			Two Piece Ceramic Hard Face Material Under Compression
			Two Piece Ceramic Hard Face Material Under Tension
			One Piece Plated TC Hard Face Material Under Compression
			One Piece Plated TC Hard Face Material Under Tension
			Two Piece Plated TC Hard Face Material Under Compression
			Two Piece Plated TC Hard Face Material Under Tension
			One Piece Nick. Bonded TC Hard Face Material Under Compression
			One Piece Nick. Bonded TC Hard Face Material Under Tension
			Two Piece Nick. Bonded TC Hard Face Material Under Compression
			Two Piece Nick. Bonded TC Hard Face Material Under Tension
			One Piece Rxn Bond SC Hard Face Material Under Compression
			One Piece Rxn Bond SC Hard Face Material Under Tension
			Two Piece Rxn Bond SC Hard Face Material Under Compression
			Two Piece Rxn Bond SC Hard Face Material Under Tension
			One Piece Alpha SC Hard Face Material Under Compression
			One Piece Alpha SC Hard Face Material Under Tension
			Two Piece Alpha SC Hard Face Material Under Compression
			Two Piece Alpha SC Hard Face Material Under Tension
			One Piece Chrome Oxide Hard Face Material Under Compression
			One Piece Chrome Oxide Hard Face Material Under Tension
			Two Piece Chrome Oxide Hard Face Material Under Compression
			Two Piece Chrome Oxide Hard Face Material Under Tension
			Practice of replacing hard seal faces on cartridge and component seals.
			Practice of reusing relapped hard seal faces on cartridge and component seals.
			Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.
			Practice of replacing rotary units with fretting corrosion visible on ID of faces

FIG. 12C

	t	Practice of reusing rot[redacted]s with fretting corrosion (common on rotary faces that use tefl[redacted]gs) visible on ID of faces (Most [redacted] on stainless steel chrome oxide plated faces)	
I/B Rotary Face Materials of Construction	Cartridge & Component	Practice of using OEM certified faces in repair/rebuild	
		Practice of not using OEM certified faces in repair/rebuild	
		One Piece Carbon Soft Face Material Under Compression	
		One Piece Carbon Soft Face Material Under Tension	
		Two Piece Carbon Soft Face Material Under Compression	
		Two Piece Carbon Soft Face Material Under Tension	
		Practice of replacing soft seal faces on cartridge and component seals.	
		Practice of reusing relapped soft seal faces on cartridge and component seals.	
		One Piece Ceramic Hard Face Material Under Compression	
		One Piece Ceramic Hard Face Material Under Tension	
		Two Piece Ceramic Hard Face Material Under Compression	
		Two Piece Ceramic Hard Face Material Under Tension	
		One Piece Plated TC Hard Face Material Under Compression	
		One Piece Plated TC Hard Face Material Under Tension	
		Two Piece Plated TC Hard Face Material Under Compression	
		Two Piece Plated TC Hard Face Material Under Tension	
		One Piece Nick. Bonded TC Hard Face Material Under Compression	
		One Piece Nick. Bonded TC Hard Face Material Under Tension	
		Two Piece Nick. Bonded TC Hard Face Material Under Compression	
		Two Piece Nick. Bonded TC Hard Face Material Under Tension	
		One Piece Rxn Bond SC Hard Face Material Under Compression	
		One Piece Rxn Bond SC Hard Face Material Under Tension	
		Two Piece Rxn Bond SC Hard Face Material Under Compression	
		Two Piece Rxn Bond SC Hard Face Material Under Tension	
		One Piece Alpha SC Hard Face Material Under Compression	
		One Piece Alpha SC Hard Face Material Under Tension	Yes
		Two Piece Alpha SC Hard Face Material Under Compression	
		Two Piece Alpha SC Hard Face Material Under Tension	
		One Piece Chrome Oxide Hard Face Material Under Compression	
		One Piece Chrome Oxide Hard Face Material Under Tension	
		Two Piece Chrome Oxide Hard Face Material Under Compression	
		Two Piece Chrome Oxide Hard Face Material Under Tension	
		Practice of replacing hard seal faces on cartridge and component seals.	
		Practice of reusing relapped hard seal faces on cartridge and component seals.	
		Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
		Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
	Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
		Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
I/B Faces In Combination	Cartridge & Component	Soft Face Combination Carbon/Carbon	
		Soft Face Combination Carbon/Ceramic	
		Soft Face Combination Carbon/Plated TC	
		Soft Face Combination Carbon/Nick. Bonded TC	
		Soft Face Combination Carbon/Rxn Bond SC	
		Soft Face Combination Carbon/Alpha SC	
		Soft Face Combination Carbon/Chrome Oxide	
	Cartridge & Component	Hard Face Combination SC/SC	
		Hard Face Combination SC/TC	
		Hard Face Combination TC/TC	
		Hard Face Combination Cer/Cer	
Faces			
		Practice of using OEM certified faces in repair/rebuild	
		Practice of not using OEM certified faces in repair/rebuild	
		One Piece Carbon Soft Face Material Under Compression	
		One Piece Carbon Soft Face Material Under Tension	
		Two Piece Carbon Soft Face Material Under Compression	
		Two Piece Carbon Soft Face Material Under Tension	

FIG. 120

O/B Stationary Face Materials of Construction	Cartridge & Component	Practice of replacing so[redacted]aces on cartridge and component seals.	
		Practice of reusing relapped soft seal faces on cartridge and component seals.	
		One Piece Ceramic Hard Face Material Under Compression	
		One Piece Ceramic Hard Face Material Under Tension	
		Two Piece Ceramic Hard Face Material Under Compression	
		Two Piece Ceramic Hard Face Material Under Tension	
		One Piece Plated TC Hard Face Material Under Compression	
		One Piece Plated TC Hard Face Material Under Tension	
		Two Piece Plated TC Hard Face Material Under Compression	
		Two Piece Plated TC Hard Face Material Under Tension	
		One Piece Nick. Bonded TC Hard Face Material Under Compression	
		One Piece Nick. Bonded TC Hard Face Material Under Tension	
		Two Piece Nick. Bonded TC Hard Face Material Under Compression	
		Two Piece Nick. Bonded TC Hard Face Material Under Tension	
		One Piece Rxn Bond SC Hard Face Material Under Compression	
		One Piece Rxn Bond SC Hard Face Material Under Tension	
		Two Piece Rxn Bond SC Hard Face Material Under Compression	
		Two Piece Rxn Bond SC Hard Face Material Under Tension	
		One Piece Alpha SC Hard Face Material Under Compression	
		One Piece Alpha SC Hard Face Material Under Tension	
		Two Piece Alpha SC Hard Face Material Under Compression	
		Two Piece Alpha SC Hard Face Material Under Tension	
		One Piece Chrome Oxide Hard Face Material Under Compression	
		One Piece Chrome Oxide Hard Face Material Under Tension	
		Two Piece Chrome Oxide Hard Face Material Under Compression	
		Two Piece Chrome Oxide Hard Face Material Under Tension	
		Practice of replacing hard seal faces on cartridge and component seals.	
		Practice of reusing relapped hard seal faces on cartridge and component seals.	
		Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
		Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
	Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
		Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
O/B Rotary Face Materials of Construction	Cartridge & Component	Practice of using OEM certified faces in repair/rebuild	
		Practice of not using OEM certified faces in repair/rebuild	
		One Piece Carbon Soft Face Material Under Compression	
		One Piece Carbon Soft Face Material Under Tension	
		Two Piece Carbon Soft Face Material Under Compression	
		Two Piece Carbon Soft Face Material Under Tension	
		Practice of replacing soft seal faces on cartridge and component seals.	
		Practice of reusing relapped soft seal faces on cartridge and component seals.	
		One Piece Ceramic Hard Face Material Under Compression	
		One Piece Ceramic Hard Face Material Under Tension	
		Two Piece Ceramic Hard Face Material Under Compression	
		Two Piece Ceramic Hard Face Material Under Tension	
		One Piece Plated TC Hard Face Material Under Compression	
		One Piece Plated TC Hard Face Material Under Tension	
		Two Piece Plated TC Hard Face Material Under Compression	
		Two Piece Plated TC Hard Face Material Under Tension	
		One Piece Nick. Bonded TC Hard Face Material Under Compression	
		One Piece Nick. Bonded TC Hard Face Material Under Tension	
		Two Piece Nick. Bonded TC Hard Face Material Under Compression	
		Two Piece Nick. Bonded TC Hard Face Material Under Tension	
		One Piece Rxn Bond SC Hard Face Material Under Compression	
		One Piece Rxn Bond SC Hard Face Material Under Tension	
		Two Piece Rxn Bond SC Hard Face Material Under Compression	
		Two Piece Rxn Bond SC Hard Face Material Under Tension	

FIG. 12E

			One Piece Alpha SC H[redacted]e Material Under Compression	
			One Piece Alpha SC Hard Face Material Under Tension	
			Two Piece Alpha SC Hard Face Material Under Compression	
			Two Piece Alpha SC Hard Face Material Under Tension	
			One Piece Chrome Oxide Hard Face Material Under Compression	
			One Piece Chrome Oxide Hard Face Material Under Tension	
			Two Piece Chrome Oxide Hard Face Material Under Compression	
			Two Piece Chrome Oxide Hard Face Material Under Tension	
			Practice of replacing hard seal faces on cartridge and component seals.	
			Practice of reusing relapped hard seal faces on cartridge and component seals.	
			Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
		Componen t	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
			Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
	O/B Faces In Combinati on	Cartridge & Componen t	Soft Face Combination Carbon/Carbon	
			Soft Face Combination Carbon/Ceramic	
			Soft Face Combination Carbon/Plated TC	
			Soft Face Combination Carbon/Nick. Bonded TC	
			Soft Face Combination Carbon/Rxn Bond SC	
			Soft Face Combination Carbon/Alpha SC	
			Soft Face Combination Carbon/Chrome Oxide	
			Hard Face Combination SC/SC	
			Hard Face Combination SC/TC	
			Hard Face Combination TC/TC	
			Hard Face Combination Cer/Cer	
Elastomers	I/B Design	Cartridge & Componen t	O-ring Elastomer Type	
			Teflon V-Ring Elastomer Type	Yes
			Teflon Wedge-Ring Elastomer Type	
			Teflon U-Cup Elastomer Type	
	I/B Materials of Constructi on	Cartridge & Componen t	Viton Elastomer Material	
			EPR Elastomer Material	
			Teflon Elastomer Material	
			Aflas Elastomer Material	
			Kalrez Elastomer Material	
			Chemraz Elastomer Material	
			Graphoil Elastomer Material	
	O/B Design	Cartridge & Componen t	O-ring Elastomer Type	
			Teflon V-Ring Elastomer Type	
			Teflon Wedge-Ring Elastomer Type	
			Teflon U-Cup Elastomer Type	
	O/B Materials of Constructi on	Cartridge & Componen t	Viton Elastomer Material	
			EPR Elastomer Material	
			Teflon Elastomer Material	
			Aflas Elastomer Material	
			Kalrez Elastomer Material	
			Chemraz Elastomer Material	
			Graphoil Elastomer Material	
	Repair & Rebuilding Procedures	Cartridge & Componen t	Practice of using OEM certified elastomers in repair/rebuild	
			Practice of not using OEM certified elastomers in repair/rebuild	
			Practice of replacing elastomers	
			Practice of reusing elastomers	
	Design	Cartridge & Componen t	Spring Type (Wave Spring)	
			Spring Type (Single Coil)	
			Spring Type (Multiple Coil)	Yes
			Metal Bellows Design	
			Out of Fluid Design	
			Immersed in process fluid Design	Yes
	Materials	Cartridge	316SS Metallurgy	

FJG. 12F

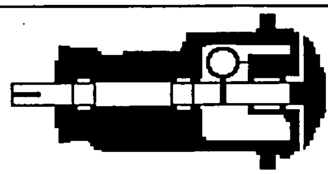
Face Energizing Mechanism	of construction	& Component	Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified springs in repair/rebuild	
			Practice of not using OEM certified springs in repair/rebuild	
			Practice of using OEM certified metal bellows in repair/rebuild	
			Practice of not using OEM certified metal bellows in repair/rebuild	
			Practice of replacing springs	
			Practice of reusing springs	
			Practice of replacing metal bellows	
			Practice of reusing metal bellows	
Gaskets	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified gaskets in repair/rebuild	
			Practice of not using OEM certified gaskets in repair/rebuild	
			Practice of replacing gaskets	
			Practice of reusing gaskets	
Seal Settings			 Stuffing Box Face Perpendicularity	.003"

FIG. 12G

		Process Fluid
		Acetone; Tem <210 F — 1302
		System Recommendations
	Product Temperature	150 F
	Product Crystalizes	Yes
	Product Polymerizes	Yes
	Product is Thermal Sensitive	No
	Specific Gravity	1.1
	Vapor Pressure	45 PSIA
	Viscosity	15000 SSU
	Concentration	75%
	% Dissolved Solids	1%
	% Undissolved Non-Fibrous Solids	0.50%
	% Undissolved Fibrous Solids	2%

1304

FIG. 13

FIG. 14A

1400	MTBF (Mean Time Between Failure) for seals in years	
1402	# of days/year plant operates	
1404	# of hours/day plant operates	
1406	Kilowatts/hours for Avg. balanced seal	
	Additional power required for unbalanced seal	
1408	Average # of repacks er year	
	Average # of adjustments per year per box	
	Average Life of Shaft/Sleeve (in years) Before Replacement Is Required Due To Packing & Bearing Failure Damage	
	Avg. Seal Water (in gpm) Flush Entering Each Packed Stuffing Box , Entering the process stream	
	Average Seal Water Flush (in gpm) required for a single mechanical seal entering the process stream.	
	The Reduction in Seal Water Usage Per Stuffing Box By The Use Of Mechanical Seals	
	Change In Temp. Difference Between System Temp. and Seal Water Flush Temp. (Ex. 85 Deg.F. system temp. , 65Deg.F. Seal Water Temp = 20 Deg.F.)	
	Avg. Requirement For A Packed Pump is 2KW Per Hour. Avg. For A Balanced Mechanical Seal Is .33KW Per Hour (The Excess Power Required Per Pump Is 1.67 KW/Hour) Based on 2.000 " seal, adjust up or down by average shaft/ sleeve size in plant	
	Avg. Leakage of Each Stuffing Box in Drops/Min	
	# of Machines With Unscheduled Downtime	
Overall Plant Information	% of Equip. Requiring Unscheduled Repairs As a Result of Excess Leakage (Ex. Bearing failure due to product leakage contamination)	
	Frequency of shaft /sleeve replacement	
	% of Component Seals In Which Installation Is Not Correct The First Time	
	Increased MTBF provided by superior seal design. Average Decrease In Seal Life For The Entire Plant Seal Population Due To Existing Design Deficiencies	
	Increased MTBF provided by ESP software technologies assuring that the correct seals with correct materials of construction and environmental controls with engineering documentation provides unsurpassed plant efficiencies.	
	Increased MTBF provided plant reliability software which enables identification of problems preventing reinstallation of those problems.	
	Overall Decrease in Seal Life Due To Premature Failure. (Over compressed & Under compressed component and erroneous installations)	
	Additional Hours Req'd For Installation vs. Cartridge Design	

Labor Information	Additional Hours Req'd For Component vs. Cartridge Design	
	Average Installation Time For A Component Seal	
	Hours Required For Disassembly & Reinstallation of Seal	
	Average # of Manhours Per Repack	
	Average # of Manhours Per Adjustment	
	Average # of Manhours Per Replacement	
	# of Hours Machinery Is Down Per Year Due to Eqpt Failure Attributed to Product Leakage	
	# of Housekeeping / Hours Per Year Per Pump (Cleaning Leakage)	
	# of Hours To Install One Mechanical Seal	

FIG. 14B

FIG. 15

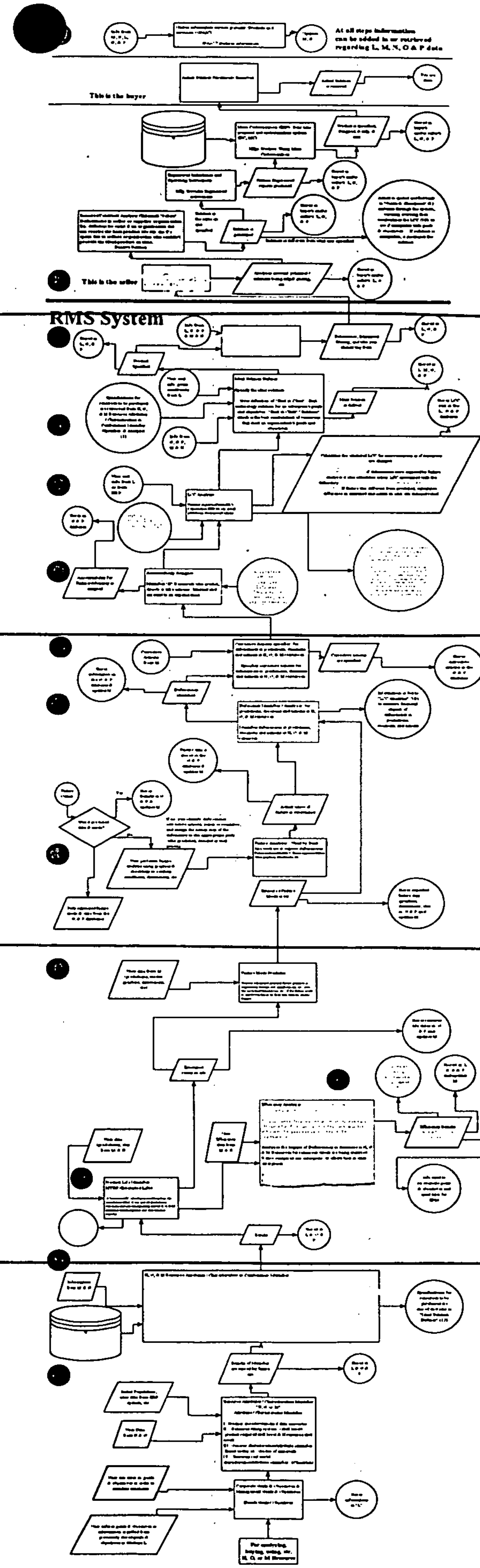


FIG. 16E

FIG. 16D

FIG. 16C

FIG. 16B

FIG. 16A

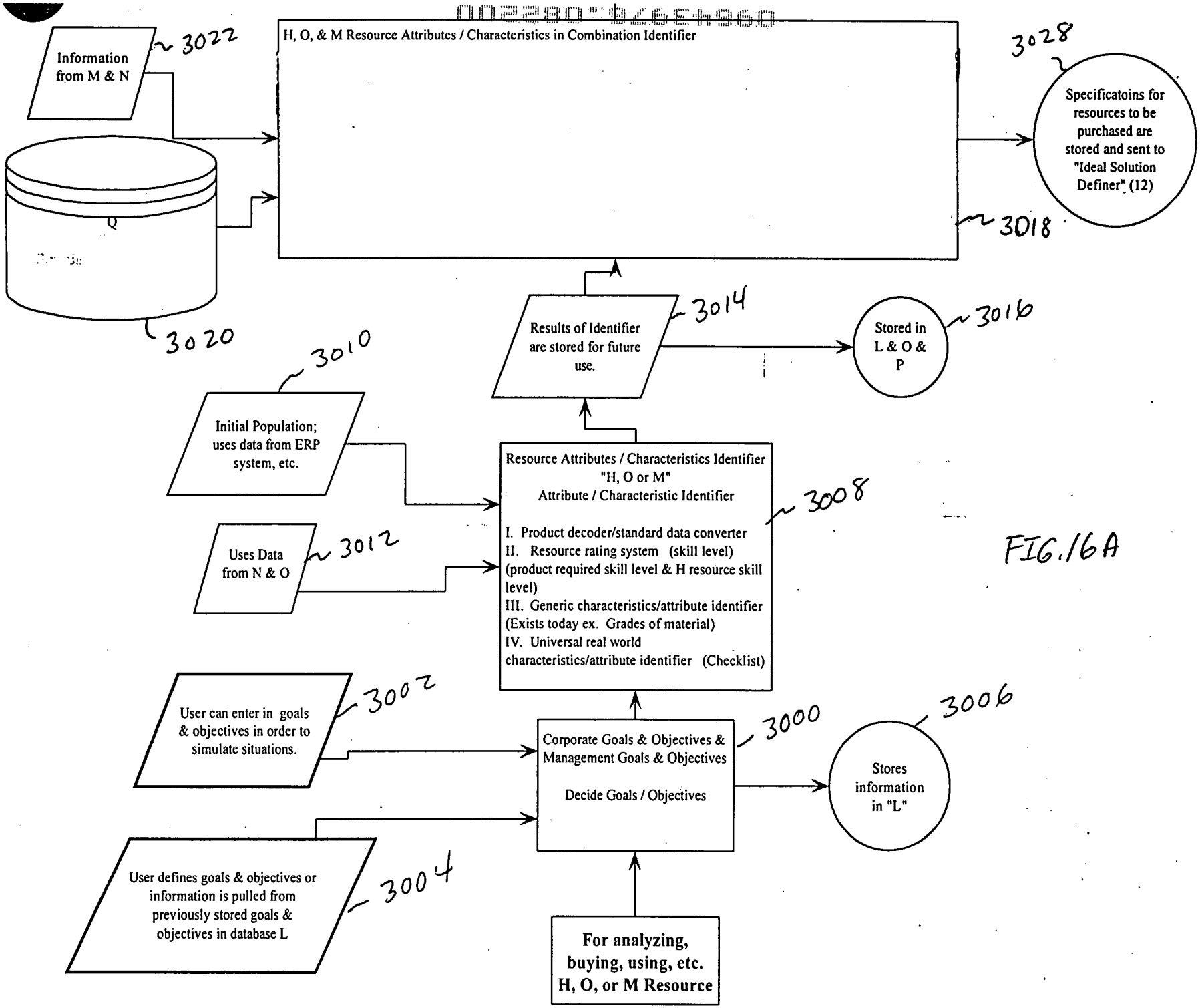

Information from M & N
3022
H, O, & M Resource Attributes / Characteristics in Combination Identifier
3028
Specificatoins for resources to be purchased are stored and sent to "Ideal Solution Definer" (12)
3018
3020
Results of Identifier are stored for future use.
3014
Stored in L & O & P
3016
3010
Initial Population; uses data from ERP system, etc.
Resource Attributes / Characteristics Identifier
"H, O or M"
Attribute / Characteristic Identifier
I. Product decoder/standard data converter
II. Resource rating system (skill level) (product required skill level & H resource skill level)
III. Generic characteristics/attribute identifier (Exists today ex. Grades of material)
IV. Universal real world characteristics/attribute identifier (Checklist)
3008
Uses Data from N & O
3012
User can enter in goals & objectives in order to simulate situations.
3002
Corporate Goals & Objectives & Management Goals & Objectives
Decide Goals / Objectives
3000
Stores information in "L"
3006
User defines goals & objectives or information is pulled from previously stored goals & objectives in database L
3004
For analyzing, buying, using, etc. H, O, or M Resource

FIG. 16A

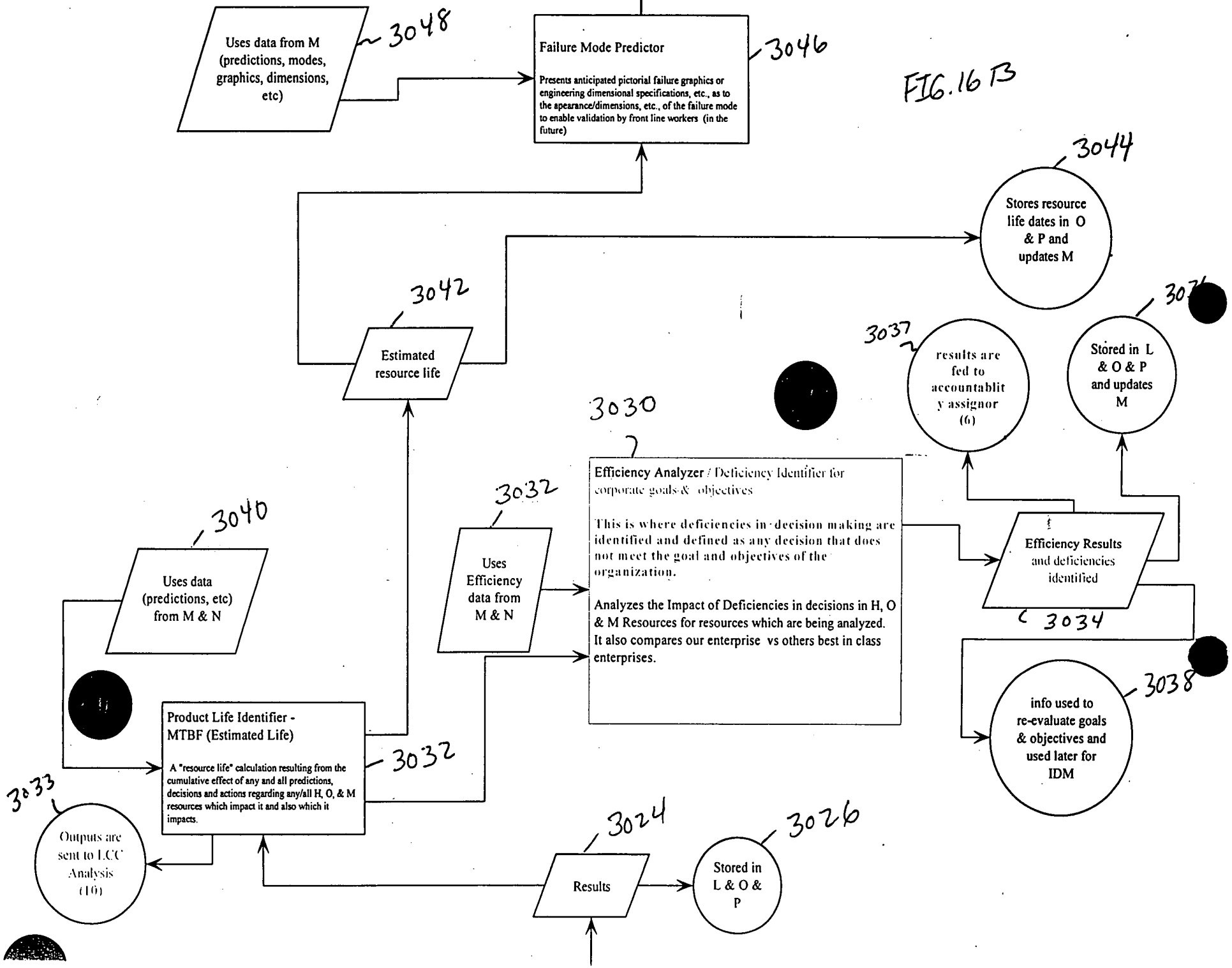


FIG. 16B

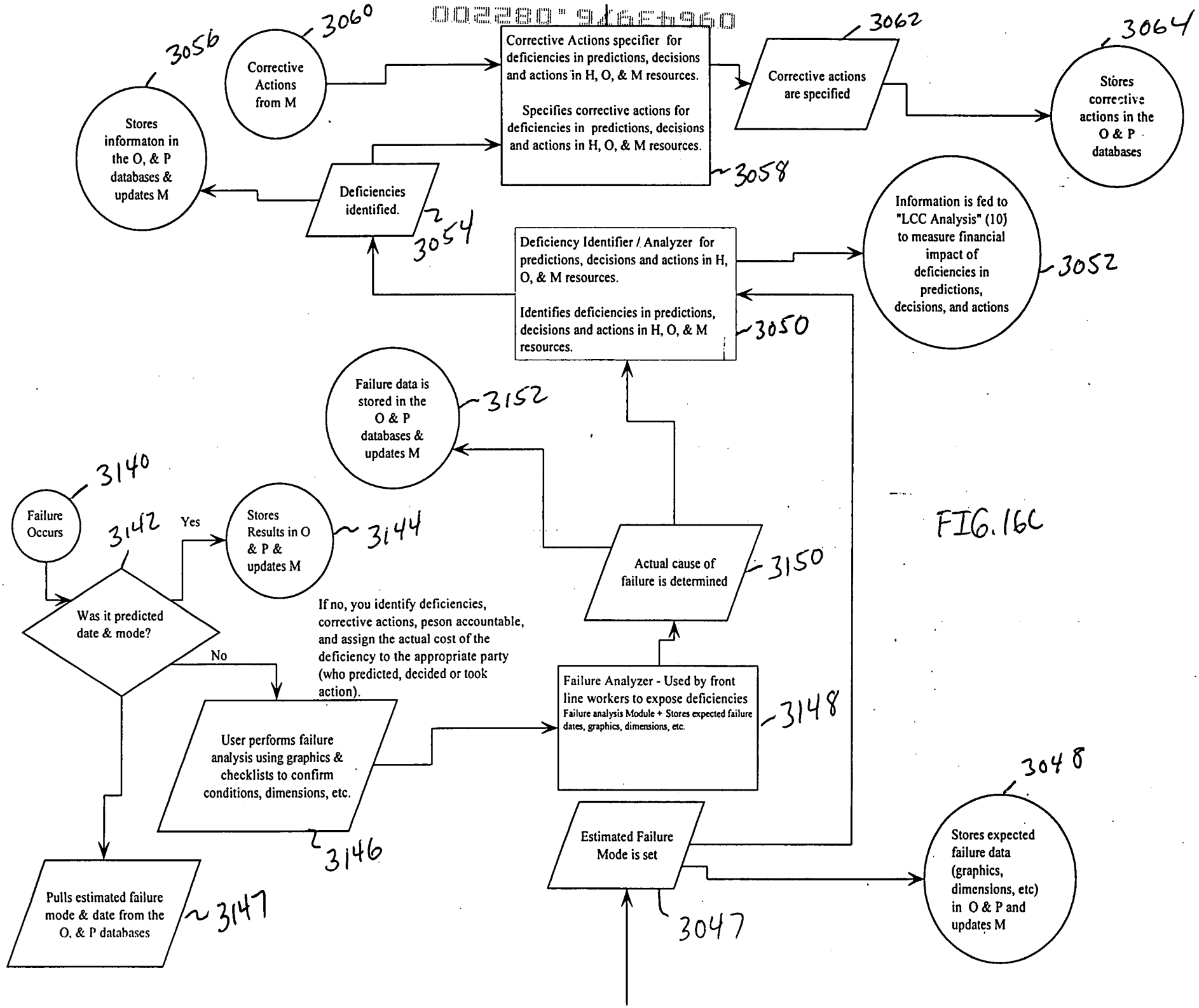
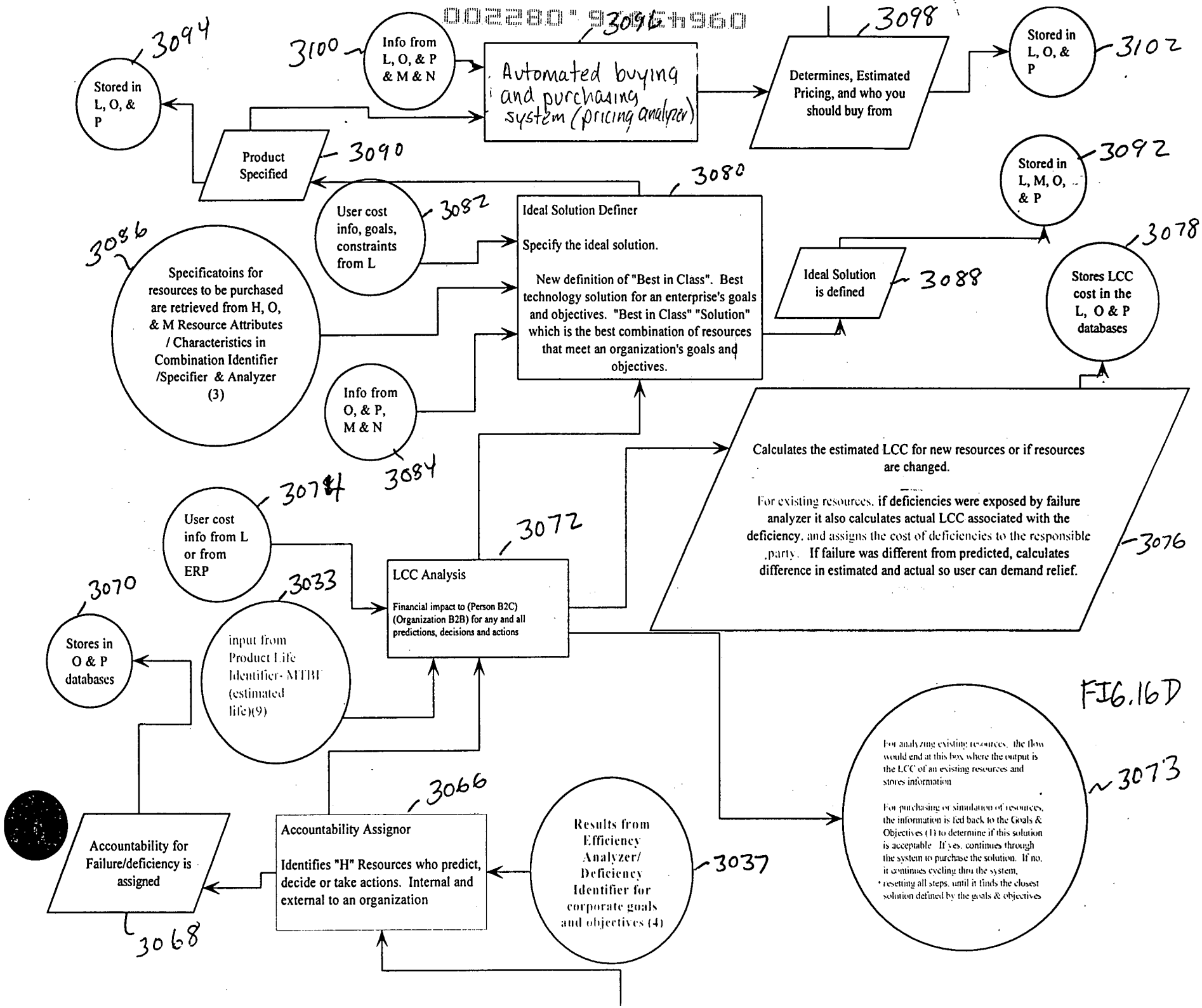
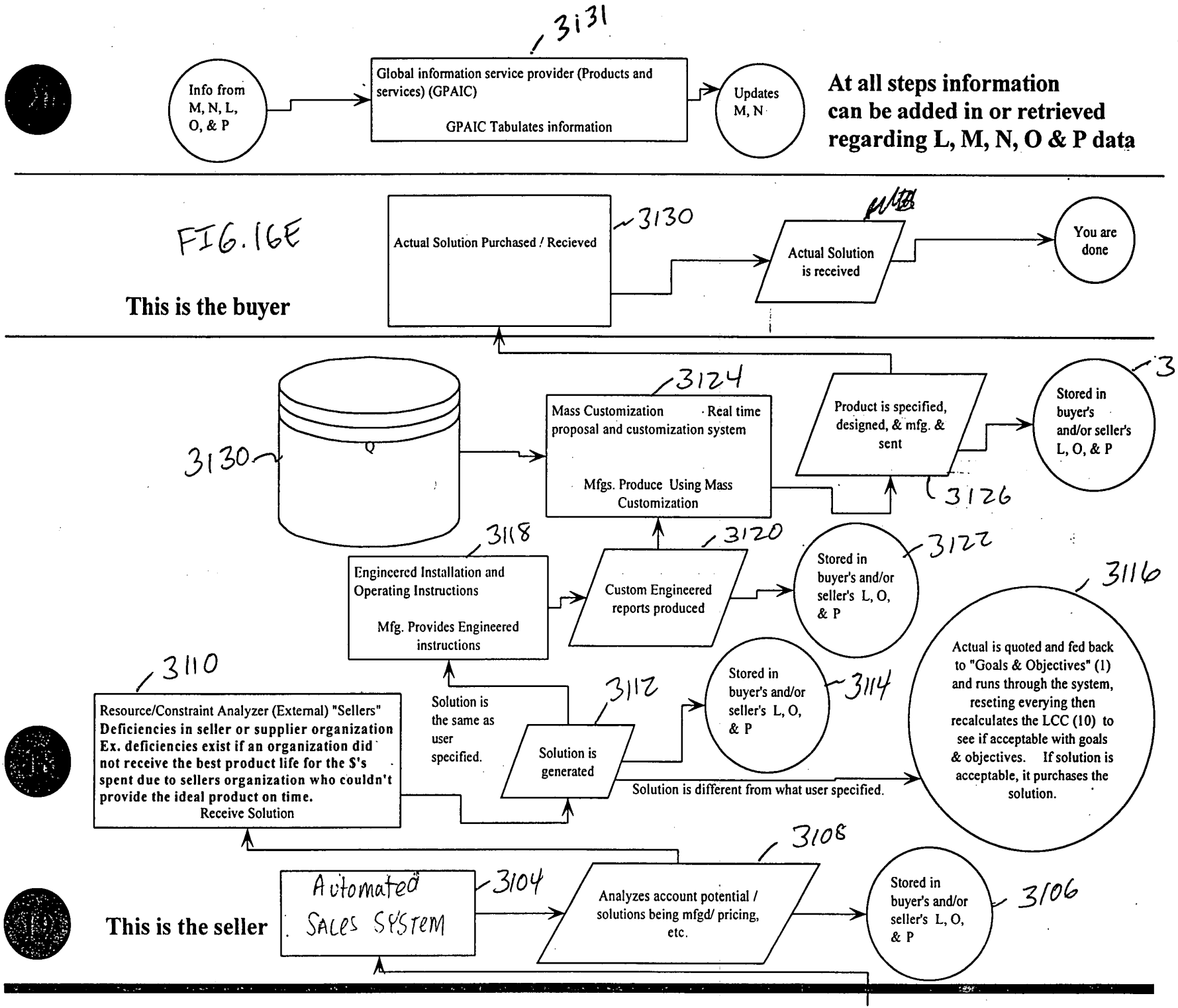

3060
Corrective Actions from M
3056
Stores informaton in the O, & P databases & updates M
Corrective Actions specifier for deficiencies in predictions, decisions and actions in H, O, & M resources.
Specifies corrective actions for deficiencies in predictions, decisions and actions in H, O, & M resources.
3058
3062
Corrective actions are specified
3064
Stores corrective actions in the O & P databases
Deficiencies identified.
3054
Deficiency Identifier / Analyzer for predictions, decisions and actions in H, O, & M resources.
Identifies deficiencies in predictions, decisions and actions in H, O, & M resources.
3050
Information is fed to "LCC Analysis" (10) to measure financial impact of deficiencies in predictions, decisions, and actions
3052
Failure data is stored in the O & P databases & updates M
3152
3140
Failure Occurs
3142
Was it predicted date & mode?
Yes
Stores Results in O & P & updates M
3144
No
If no, you identify deficiencies, corrective actions, peson accountable, and assign the actual cost of the deficiency to the appropriate party (who predicted, decided or took action).
Actual cause of failure is determined
3150
Failure Analyzer - Used by front line workers to expose deficiencies
Failure analysis Module + Stores expected failure dates, graphics, dimensions, etc.
3148
User performs failure analysis using graphics & checklists to confirm conditions, dimensions, etc.
3146
Estimated Failure Mode is set
3047
3048
Stores expected failure data (graphics, dimensions, etc) in O & P and updates M
Pulls estimated failure mode & date from the O, & P databases
3147

FIG. 16C


3094
Stored in L, O, & P
3100
Info from L, O, & P & M & N
Automated buying and purchasing system (pricing analyzer)
3096
3098
Determines, Estimated Pricing, and who you should buy from
Stored in L, O, & P
3102
Product Specified
3090
3080
Stored in L, M, O, & P
3092
User cost info, goals, constraints from L
3082
Ideal Solution Definer
Specify the ideal solution.
New definition of "Best in Class". Best technology solution for an enterprise's goals and objectives. "Best in Class" "Solution" which is the best combination of resources that meet an organization's goals and objectives.
3086
Specificatoins for resources to be purchased are retrieved from H, O, & M Resource Attributes / Characteristics in Combination Identifier /Specifier & Analyzer (3)
Ideal Solution is defined
3088
3078
Stores LCC cost in the L, O & P databases
Info from O, & P, M & N
3084
Calculates the estimated LCC for new resources or if resources are changed.
For existing resources, if deficiencies were exposed by failure analyzer it also calculates actual LCC associated with the deficiency, and assigns the cost of deficiencies to the responsible party. If failure was different from predicted, calculates difference in estimated and actual so user can demand relief.
3076
User cost info from L or from ERP
3074
3072
LCC Analysis
Financial impact to (Person B2C) (Organization B2B) for any and all predictions, decisions and actions
3070
Stores in O & P databases
3033
input from Product Life Identifier- MTBF (estimated life)(9)
FIG.16D
For analyzing existing resources, the flow would end at this box where the output is the LCC of an existing resources and stores information
For purchasing or simulation of resources, the information is fed back to the Goals & Objectives (1) to determine if this solution is acceptable. If yes, continues through the system to purchase the solution. If no, it continues cycling thru the system,
• resetting all steps, until it finds the closest solution defined by the goals & objectives
3073
3066
Accountability for Failure/deficiency is assigned
Accountability Assignor
Identifies "H" Resources who predict, decide or take actions. Internal and external to an organization
Results from Efficiency Analyzer/ Deficiency Identifier for corporate goals and objectives (4)
3037
3068


3131
Info from M, N, L, O, & P
Global information service provider (Products and services) (GPAIC)
GPAIC Tabulates information
Updates M, N
At all steps information can be added in or retrieved regarding L, M, N, O & P data
FIG. 16E
This is the buyer
Actual Solution Purchased / Recieved
3130
Actual Solution is received
You are done
3130
3124
Mass Customization · Real time proposal and customization system
Mfgs. Produce Using Mass Customization
Product is specified, designed, & mfg. & sent
3126
Stored in buyer's and/or seller's L, O, & P
3128
3118
Engineered Installation and Operating Instructions
Mfg. Provides Engineered instructions
3120
Custom Engineered reports produced
Stored in buyer's and/or seller's L, O, & P
3122
3116
Actual is quoted and fed back to "Goals & Objectives" (1) and runs through the system, reseting everying then recalculates the LCC (10) to see if acceptable with goals & objectives. If solution is acceptable, it purchases the solution.
3110
Resource/Constraint Analyzer (External) "Sellers"
Deficiencies in seller or supplier organization
Ex. deficiencies exist if an organization did not receive the best product life for the $'s spent due to sellers organization who couldn't provide the ideal product on time.
Receive Solution
Solution is the same as user specified.
3112
Solution is generated
Stored in buyer's and/or seller's L, O, & P
3114
Solution is different from what user specified.
This is the seller
Automated Sales System
3104
3108
Analyzes account potential / solutions being mfgd/ pricing, etc.
Stored in buyer's and/or seller's L, O, & P
3106

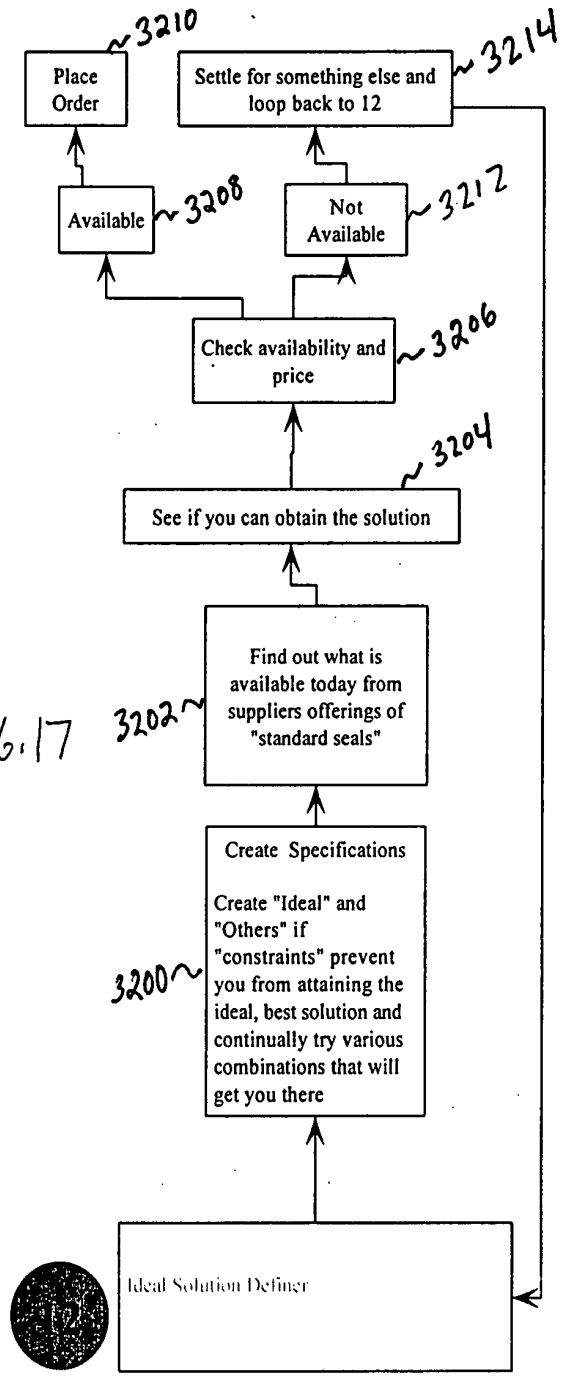

3210
Place Order
Settle for something else and loop back to 12
3214
Available
3208
Not Available
3212
Check availability and price
3206
3204
See if you can obtain the solution
Find out what is available today from suppliers offerings of "standard seals"
3202
Create Specifications
Create "Ideal" and "Others" if "constraints" prevent you from attaining the ideal, best solution and continually try various combinations that will get you there
3200
Ideal Solution Definer

FIG. 17

FIG. 18A

1800

1	Each test is performed under controlled laboratory conditions with pre-selected expert individuals. Estimated life of each in a controlled environment on test stands	Raw Material Mfgs Perform Laboratory Tests	Mfg. of Component			Face Suppliers			O-ring Suppliers			Gland Suppliers	Gasket Suppliers	Spring Suppliers
			Material			Material PG523	Material PG792	Material PG957	Grade A	Grade B	Grade C	Etc.	Etc.	Etc.
			Estimated Life			Estimated life 5 years 1808	Estimated life 15 years	Estimated life 35 years	Estimated life 1 year	Estimated life 5 years 1810	Estimated life 10 years	12 years	5 years	20 years
			1802											
2	Each test is performed under controlled laboratory conditions with pre-selected expert individuals. Estimated life of each in a controlled environment Ex. Water and 6% oil solution, 70 degrees, dust fee room, etc., etc.,	Component Mfgs Perform Laboratory Tests	Mfg. of Subassembly	Bearing Mfgs		Bearing Protection Mfgs	Seal Mfgs					Shaft Mfgs	Impeller Mfgs	Human
			Design	Option 1 CB Design with lube filter system	Option 2 DL Design	Double lip seal design made of Viton with x durometer,	Balanced design 75/20 with face width of 100 with multi coil springs, etc.					Shaft with L3/D4 of 3 made of 316SS with bearing tolerance of .005	Open impeller design	Scientists / experts assemble in clean room environment, etc. etc.
			Estimated Life	Estimated life 30 years	Estimated life 15 years	Estimated life 6 years	Estimated life 5 years 1812					Estimated life 50 years	Estimated life 6 years	
			1804											
3	Tests all pieces in combination in controlled environment	Equipment Mfgs Perform Laboratory Tests	Mfg. of Assembly	Pump Mfgs										
				~~Very limited controlled environment testing. Controlled laboratory conditions of 70 degrees, same trained expert installs all components, etc.~~										
			Design	Bearing Housing Fits .0025	Bearing Housing Fits .010	Frame Adapter Fits < .005	Frame Adapter Fits .005-.015	Rigidity of Shaft based on overhang	Design with axial shaft play < .006	Design with axial shaft play .006-.010	Seal mfg Life from above			
			Estimated Life for each item	10 years	3 years	15 years	5 years		10 years	5 years	5 years			

1814

			Assembly Estimated Life	Estimated life could have been 12 years but now it is 3 years due to less than best in class offerings
			~1806	

4	Invention combines scientists findings with field findings of "H", "O", & "M" resources in combination and enables predicted outcomes	Users perform Real World testing	**User of Assembly**	**End User Plants (Real World)**					
			Design	Installation of Pump with H skill level of 1	Installation of pump with H skill level of 10	Equipment Condition Shaft Run out < .004	Equipment Condition Shaft Run out .005- .010		
			Estimated Life for each item	195 days	1095 days	1000 days	700 days		
			Assembly Estimated Life	Estimated life could have been 3 years but now it is 195 days due to less than best in class offerings					

FIG. 18B